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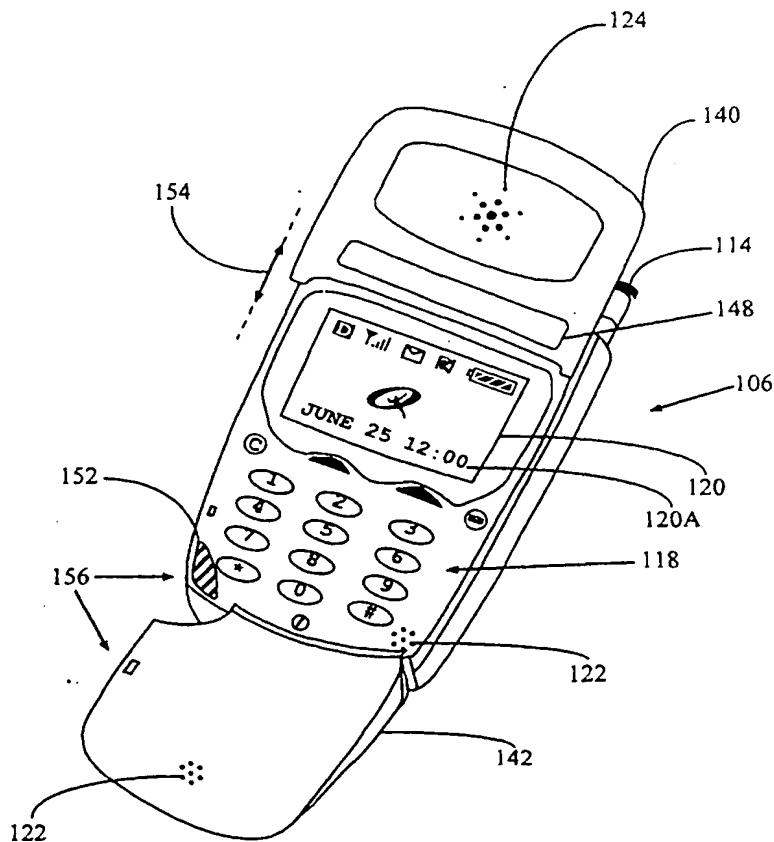
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(54) Title: WIRELESS COMMUNICATION DEVICE HOUSING AND METHOD OF OPERATION

(57) Abstract

A wireless communication device includes an antenna (114), transceiver, display (120), and keypad (118). The display and keypad are covered and protected by upper and lower cover members (140, 142), respectively. The upper cover (140) member includes a transparent portion positioned over a predetermined area of the display. The predetermined portion of the display can display data that is visible to the user without having to open the upper cover member. The display portion displays the calling party telephone number when an incoming call is received by the transceiver. The display can optionally display the time and date (120A) on the predetermined portion of the display. The device also includes an automatic opening biasing system (158) coupled to the upper and lower cover members and activated by a single activation button (152). Operation of the activation button (152) by the user results in the automatic biasing system opening and biasing the upper and lower cover members to their respective open positions.



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WIRELESS COMMUNICATION DEVICE HOUSING AND METHOD OF OPERATION

FIELD OF THE INVENTION

5 The present invention is related generally to wireless communication devices and, more particularly, to a wireless communication device housing and method of operation.

BACKGROUND OF THE INVENTION

10 Wireless communication devices, such as cellular telephones, were initially large, bulky devices. However, improvements in the technology have resulted in compact, lightweight cellular telephones that offer a variety of user options, such as time and date, caller ID, and the like.

15 The compact cellular telephones are small enough to conveniently clip onto a belt or, in some cases, are even small enough to fit within a pocket. With storage on belt or in a shirt pocket, there is increased possibility of inadvertent activation of the cellular telephone. For example, the jostling of a cellular telephone in a shirt pocket may result in the inadvertent activation of one or more keys on a keypad. To avoid such inadvertent operation, some cellular
20 telephones include a cover to protect the keypad from inadvertent activation. However, the addition of a cover can make the cellular telephone more difficult to operate since the user must first open the protective cover to activate the keys.

25 Therefore, it can be appreciated that there is a significant need for a wireless communication device and housing that provides the desired protective function and is easy and convenient to use. The present invention provides this and other advantages as will be apparent from the following figures and accompanying description.

30

SUMMARY OF THE INVENTION

35 The present invention is embodied in a system and method directed to a housing for a wireless communication device. In one embodiment, the wireless communication device includes a transceiver to communicate with the communication device remote from the wireless communication device. The device further includes a housing with first and second ends containing the transceiver. A first cover member is attached to the housing first end and has a

stored position and an open position. A second cover member is attached to the housing second end and also has a stored position and an open position. The device also includes an activation button, supported by the housing, and operable by a user to permit movement of the first and second cover members
5 from the stored position to the open position.

In an exemplary embodiment, the device includes a biasing member coupled to the activation button to automatically move the first and second cover members from the stored position to the open position when operated by the user. The biasing member may be a spring or other known device. The
10 device may also include a dampening element to restrict the speed of movement of the first and second cover members from the stored position to the open position.

In one embodiment, the first cover member is rotatably attached to the housing and rotates from the stored position to the open position when the
15 activation button is operated by the user. The second cover member may be slideably attached to the housing second end and slides from the stored position to the open position when the activation button is operated by the user.

The wireless communication device may also include an output transducer mounted in the second cover member to produce audio output
20 signals. The output transducer is spaced apart from the first cover member by a predetermined distance when the first and second cover members are in the open position. The predetermined distance may be based on anthropometric data related to a distance between an ear of the user and a region near the mouth of the user.

The wireless communication device may also include a display to display information. A portion of the display may be used to display a number associated with an incoming call received by the transceiver. In one
25 embodiment, the display is covered by the second cover member when in the stored position. The wireless communication device may further include a transparent portion in the second cover member to permit viewing of the display portion when the second cover member is in the stored position so the user can view the number of the incoming call without having to open the
30 second cover member. In one embodiment, the transparent portion of the second cover member comprises a lens. The wireless communication device can also include a clock to provide a clock signal with the display portion displaying the clock signal when the second cover member is in the stored
35 position and the wireless communication device is not receiving an incoming call.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a functional block diagram of an exemplary embodiment of the wireless communication device of the present invention.

FIG. 2A is a top plan view of an embodiment of the wireless communication device of FIG. 1 showing an inventive device housing in a closed configuration.

FIG. 2B is a perspective view of the wireless communication device of FIG. 2A showing the housing in an open configuration.

FIG. 3 is a cutaway perspective view of the wireless communication device of FIGS. 2A and 2B showing an automatic opening biasing system.

FIG. 4A is a cutaway side view of the wireless communication device of FIG. 2B illustrating the automatic opening biasing system.

FIG. 4B is a detailed view of the automatic opening biasing system of FIG. 4A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides a housing that protects a wireless communication device and simplifies operation thereof. While the following description is directed primarily to housing and operation of a cellular telephone communication system, it is clear that the principles of the present invention may be readily extended to any wireless communication system.

The present invention utilizes conventional telecommunication technology, but provides a housing that simplifies operation while also providing protection from inadvertent operation of the device. The present invention is embodied in a system 100 illustrated in the functional block diagram of FIG. 1. The system 100 includes a central processing unit (CPU) 102, which controls operation of the system. A memory 104, which may include both read-only memory (ROM) and random access memory (RAM), provides instructions and data to the CPU 102. A portion of the memory 104 may also include non-volatile random access memory.

The system 100, which is typically embodied in a wireless communication device such as a cellular telephone, also includes a housing 106 that contains a transmitter 108 and a receiver 110 to allow transmission and reception of data, such as audio communications, between the system 100 and a remote location, such as a cell site controller (not shown). The transmitter 108 and receiver 110 may be combined into a transceiver 112. An antenna 114 is attached to the housing 106 and electrically coupled to the transceiver 112. The

operation of the transmitter 108, receiver 110, and antenna 114 is well known in the art and need not be described herein. Although FIG. 1 illustrates the antenna 114 as extending from the housing 106, some designs may include an internal antenna that is contained completely within the housing. However, the
5 transmitter 108, receiver 110, and antenna 114 operate in a conventional manner regardless of the location of the antenna.

A keypad 118 is attached to the housing 106 for operation by the user in a conventional manner. The keypad 118 provides a convenient input device by which destination telephone numbers and commands may be entered by the
10 user.

The system 100 also includes a display 120 that may conveniently be used to display instructions to the user as well as user-entered data, such as destination telephone numbers and alphanumeric text. In an exemplary embodiment of the system 100, the display 120 will display time and date and the calling party
15 telephone number for incoming calls received by the transceiver 112. This information provides visual cues to the user and thereby assist the user in the operation of the system 100.

The system 100 also includes an audio input device, such as a microphone 122, and an audio output device, such as a speaker 124. The
20 microphone 122 and speaker 124 operate in a conventional manner to provide two-way audio communication using the system 100. As will be described in further detail below, the microphone 122 may be alternatively mounted in different positions.

The system 100 also includes a timer 122, which may typically be
25 included in the CPU 102. As will be discussed in greater detail below, the system 100 uses the timer 122 to determine the time and date. The time and date are shown on a predetermined portion of the display 120. Details of the use of the display 120 and timer 130 are provided below.

The electrical components of the system 100 receive power from a battery
30 130, which is attached to and supported by the housing 106. In an exemplary embodiment, the battery 130 is a rechargeable battery. In other embodiments, the system 100 may include a connector (not shown) for the connection of an external power source, such as an automobile power adapter, AC power adapter, or the like.

35 The various components of the system 100 are coupled together by a bus system 134, which may include a power bus, control signal bus, and status signal bus in addition to a data bus. However, for the sake of clarity, the various buses are illustrated in FIG. 1 as the bus system 134.

The housing 106 has several unique features that protect the keypad 118 from inadvertent activation while simplifying operation of the system 100 for the user. A top plan view of the system 100 is shown in FIG. 2A where the housing 106 includes an upper cover member 140 and a lower cover member 142. FIG. 2A illustrates the housing with the upper cover member 140 and lower cover member 142 in the closed or stored position. It should be noted that the system 100 may be under power and active even in the closed position. The speaker 124 is mounted in the upper cover member 140. A status indicator 146, such as an LED, provides status information to the user. For example, when an e-mail or voicemail message has been received, but not retrieved by the user, the status indicator 146 may be lit, or may blink, to provide the user with a visual cue. The upper cover member 140 also includes a transparent portion 148 which is positioned over the display 120 (see FIG. 2B) when the upper cover member is in the closed position. In an exemplary embodiment, the transparent portion 148 is a lens material to provide magnification and clarity in the display of data.

The transparent portion 148 conveniently allows the user to view the telephone number of the calling party, which is shown on the display 120. In this manner, the user can view the calling party number without opening the upper cover member 140. In an exemplary embodiment, the time and data may be conveniently displayed on the same portion of the display 124 when the system 100 is not receiving an incoming call, as illustrated in FIG. 2B. Thus, with the upper cover member 140 and lower cover member 142 in the closed position, the system 100 can display the time and the date when no incoming call is received and display the calling party number when an incoming call is received.

The housing 106 also includes an activation button 152 that releases the upper cover member 140 and lower cover member 142, and permits the movement of the cover members to an open position, illustrated in FIG. 2B. The upper and lower cover members 140 and 142 are maintained in the closed position by a latch (not shown) that is released when the user presses the activation button 152.

The upper cover member 140 is slideably attached to the housing 106. The linear displacement of the upper cover member 140 between the closed position and the open position is shown by a reference arrow 154. In contrast, the lower cover member 142 is rotatably attached to the housing 106 by a hinge (not shown). The rotational displacement of the lower cover member 142

between the closed position and the open position is shown by a reference arrow 156.

In an exemplary embodiment, the microphone 122 is mounted within the housing 106, as illustrated in FIG. 2B. Alternatively, the microphone 122 may be mounted in the lower cover member 142, shown with the dashed line to the reference 122, so as to position the microphone in proximity with the mouth of the user. However, the location of the microphone 122 in the lower cover member 142 requires mounting electrical components within the lower cover member and providing a flexible electrical connector between the housing 106 and the lower cover member. This alternative embodiment tends to increase the production cost of the system 100 and does not provide a significant performance advantage over the embodiment with the microphone 122 mounted in the housing 106. With the microphone 122 mounted in the housing 106, the lower cover member 142 is merely a passive reflector that simply reflects the user's voice to the microphone 122 in the housing 106.

In a preferred embodiment, the upper cover member 140 slides to a fully open position and the lower cover member 142 rotates to a fully open position such that the distance between the speaker 124 and the terminal portion of the lower cover member is at a predetermined distance corresponding to the typical separation between a user's ear and mouth.

As can be appreciated by those skilled in the art, the user typically places the speaker 124 directly adjacent one ear. By setting the predetermined distance to correspond to the typical separation between the ear and mouth, the lower cover member 142 will be positioned to reflect the speaker's voice in the desired manner. In an exemplary embodiment, the predetermined distance is based on anthropometric data of the ear-to-mouth separation distance for an average adult. However, the separation between the speaker 124 and lower cover member 142 is not critical since the lower cover member is a passive component that merely reflects the speaker's voice. Accordingly, the present invention is not limited by the specific distance separating the speaker 124 and the lower cover member 142.

As best seen in FIG. 2B, the display 120 includes a display portion 120a where the system 100 can display the time and date. When an incoming call is detected by the transceiver 112 (see FIG. 1), the calling party telephone number may be shown on the display portion 120a instead of the time and date. As previously discussed, the display portion 120a is positioned so that it is directly beneath the transparent portion 148 when the upper cover member 140 is in the

closed position. It should be noted that the display of time and date is merely a convenient option, and need not be shown on the display portion 120a.

In one embodiment, the user presses the activation button 152 and manually positions the upper cover member 140 and lower cover member 142 into their respective open positions. However, in one preferred embodiment, the system 100 includes an automatic opening biasing system 158, illustrated in FIG. 3, to automatically position the upper cover member 140 and lower cover member 142 into their respective open positions upon the user pressing the activation button 152.

In an exemplary embodiment, the upper cover member 140 and lower cover member 142 are each biased into the open position by a biasing member, such as a spring 160. In the embodiment illustrated in FIG. 3, the spring 160 is wound about an axle 162. The ends of the axle 162 are connected to sprockets 164. The sprockets 164 are in turn coupled to hinge sprockets 166 that are coupled to the hinge (not shown) of the lower cover member 142. The action of the spring 160 would typically cause the lower cover member 142 to pop to the open position very quickly. However, such a fast motion is undesirable and may cause the user to lose control and possibly drop the device. The sprockets 164 and hinge sprockets 166 serve to dampen the action of the spring 160 and thereby provide a smooth opening motion to bias the lower cover member 142 into the open position. Other biasing members, such as a torsion bar or even an electric motor may be used to urge the lower cover member 142 into the open position.

While mechanical biasing elements such as the spring 160 and the torsion bar require no external power source, the electric motor requires power from the battery 130 (see FIG. 1). For this reason, an electric motor may be less desirable since it reduces the operational capability of the system by draining power from the battery 130. The system 100 may also use other dampening elements besides the sprockets 164 and hinge sprockets 166. For example, countersprings or other dampening elements may also be used to smooth the motion of the lower cover member 142.

The system 100 includes similar elements to automatically bias the upper cover member 140 into the open position. The upper cover member 140 may be coupled to the biasing system 158 or may include a separate biasing system (not shown) that functions in a similar manner to urge the upper cover member into the open position. Other known techniques may be used to provide smooth operational action of the upper cover member 140 and lower cover member 142. These known biasing techniques are intended to be within the scope of the

present invention. Accordingly, the present invention is not limited by the specific biasing system 158 used to automatically position the upper cover member 140 and lower cover member 142 into their respective open positions.

The biasing system 158 is also shown in FIGS. 4A and 4B. In FIG. 4A, which is a cutaway side view of the wireless communication device, the sprockets 164 and hinge sprockets 166 are contained within the housing 106. When the activation button 152 is pressed by the user, the spring 160 causes the sprocket 164 to rotate. Sprocket teeth 168 on the sprockets 164 are interdigitated with hinge sprocket teeth 170 on the hinge sprockets 166. As the sprockets 164 turn, the sprocket teeth 168 act upon the hinge sprocket teeth 170 and force the rotation of the hinge sprockets 166, as shown in FIG. 4B.

The system 100 offers the advantages of the newest technology to provide a lightweight, compact wireless communication device. The upper and lower cover members 140 and 142 protect the device and prevent accidental operation of the keypad 118. The upper and lower cover members 140 and 142 may be quickly moved from the closed position to the open position by pressing a single button (*i.e.*, the activation button 152). The one button operation of the upper and lower cover members 140 and 142 provide the user with the simple one handed operation of the system 100. The biasing system 158 automatically opens the upper and lower cover members 140 and 142 using a smooth opening action. In one embodiment, the upper and lower cover members 140 and 142 can be independently closed and latched such that the user can operate the system 100 with one hand. For example, the user can slide the upper cover member 140 from the open position to the closed position where a latch mechanism (not shown) latches and retains the upper cover member in the closed position. The user may then rotate the lower cover member 142 from the open position to the closed position. The latch mechanism retains the lower cover member 142 in the closed position. It should be noted that the order in which the upper and lower cover members 140 and 142 are closed is irrelevant. That is, the lower cover member 142 may be closed prior to closure of the upper cover member 140 or vice versa.

A further improvement of the system 100 is the transparent portion 148 which allows the user to view the calling party telephone number without having to open the upper cover member 140. This advantageously allows the user to determine whether or not to answer the call without having to press the activation button 152. Some conventional wireless communication devices automatically answer an incoming call when the cover is opened. Such operation may be undesirable since the user does not know who is calling until

the cover member is open and the call is already answered. However, the transparent portion 148 of the system 100 allows the user to view the calling number while the upper cover member 140 is still closed. The user can view the number and determine whether or not to press the activation button 152. Thus, 5 the system 100 can automatically answer the phone when the upper and lower cover members 140 and 142 are moved to the open position without the disadvantages of the conventional wireless communication device. As an optional feature, the display portion 120a (see FIG. 2B) may display the time and date when the system 100 is not receiving an incoming call. Thus, the 10 system 100 offers features and advantages not currently available in wireless communication devices.

It is to be understood that even though various embodiments and advantages of the present invention have been set forth in the foregoing description, the above disclosure is illustrative only, and changes may be made 15 in detail, yet remain within the broad principles of the invention. For example, the system 100 need not include the automatic opening biasing system 158. However, the biasing system 158 may be included and may take many different forms using well-known technology. Therefore, the present invention is to be limited only by the appended claims.

20 What is claimed is:

CLAIMS

1. A wireless communication device comprising:
2 a transceiver to communicate with a communication device remote from
the wireless communication device;
4 a display having a display portion indicating a telephone number
associated with an incoming call received by the transceiver;
6 a housing having a main body portion to support the display and first
and second moveable portions, each having first and second positions, the first
8 moveable portion being rotatably attached to the main body portion, the second
moveable portion being slideably attached to the main body portion and
10 overlaying at least a portion of the display when in the first position;
a transparent viewing portion mounted on the second moveable portion
12 in a location to permit viewing of the display portion when the second
moveable portion is in the first position;
14 an activation button supported by the housing and operable by a user to
permit movement of the first and second moveable portions from the first
16 position to the second position.

2. The wireless communication device of claim 1, further including a
2 biasing member coupled to the activation button to automatically move the first
and second moveable portions from the first position to the second position
4 when operated by the user.

3. The wireless communication device of claim 2 wherein the biasing
2 member comprises a spring.

4. The wireless communication device of claim 2, further including a
2 dampening element to restrict a speed of movement of the first and second
moveable portions from the first position to the second position.

5. The wireless communication device of claim 4 wherein the
2 dampening element comprises a sprocket drive element.

6. The wireless communication device of claim 1 wherein the
2 transparent portion comprises a lens to enhance viewing of the display portion
when the second moveable member is in the first position.

7. A wireless communication device comprising:
2 a transceiver to communicate with a communication device remote from
the wireless communication device;
4 a housing with first and second ends containing the transceiver;
a first cover member attached to the housing first end, the first cover
6 member having a stored position and an open position;
a second cover member attached to the housing second end, the second
8 cover member having a stored position and an open position; and
an activation button supported by the housing and operable by a user to
10 permit movement of the first and second cover members from the stored
position to the open position.

8. The wireless communication device of claim 7, further including a
2 biasing member coupled to the activation button to automatically move the first
and second cover members from the stored position to the open position when
4 operated by the user.

9. The wireless communication device of claim 8 wherein the biasing
2 member comprises a spring.

10. The wireless communication device of claim 8, further including a
2 dampening element to restrict a speed of movement of the first and second
cover members from the stored position to the open position.

11. The wireless communication device of claim 10 wherein the
2 dampening element comprises a sprocket drive element.

12. The wireless communication device of claim 7 wherein the first
2 cover member is rotatably attached to the housing first end and rotates from the
stored position to the open position when the activation button is operated by
4 the user.

13. The wireless communication device of claim 7 wherein the second
2 cover member is slideably attached to the housing second end and slides from
the stored position to the open position when the activation button is operated
4 by the user.

14. The wireless communication device of claim 7, further including
2 an output transducer mounted in second cover member and operable to
produce audio output signals, the output transducer being spaced apart from
4 the first cover member by a predetermined distance when the first and second
cover members are in the open position.

15. The wireless communication device of claim 14 wherein the
2 predetermined distance is based on anthropometric data related to a distance
between an ear of the user and a region proximate a mouth of the user:

16. The wireless communication device of claim 7, further including a
2 display to display information to the user, the display having a display portion
to display a number associated with an incoming call received by the
4 transceiver, the display portion being covered by the second cover member
when in the stored position.

17. The wireless communication device of claim 16, further including
2 a transparent portion in the second cover member to permit viewing of the
display portion when in the stored position.

18. The wireless communication device of claim 17, further including
2 a clock to provide a clock signal, the display portion displaying the clock signal
when the second cover member is in the stored position and the wireless
4 communication device is not receiving the incoming call.

19. The wireless communication device of claim 17 wherein the
2 transparent portion of the second cover member comprises a lens.

20. A wireless communication device comprising:
2 a transceiver to communicate with a communication device remote from
the wireless communication device;
4 a housing with first and second ends containing the transceiver;
a cover member attached to the housing first end and having a stored
6 position and an open position, the cover member including a transparent
portion; and
8 a display attached to the housing and having a display portion to display
a number associated with an incoming call received by the transceiver, the
10 display portion being covered by the cover member when in the stored position

12 with the transparent portion in position proximate the display portion to permit
the viewing of the number associated with an incoming call received by the
transceiver.

21. The wireless communication device of claim 20 wherein the cover
2 member is slideably attached to the housing first end and slides from the stored
position to the open position.

22. The wireless communication device of claim 20, further including
2 a clock to provide a clock signal, the display portion displaying the clock signal
when the cover member is in the stored position and the wireless
4 communication device is not receiving the incoming call.

23. The wireless communication device of claim 20 wherein the
2 transparent portion comprises a lens.

24. A method for operating a wireless communication device
2 comprising:
sensing user operation of an activation button mounted on a housing of
4 the wireless communication device;
releasing a first cover member attached to the housing first end in
6 response to user operation of the activation button, the first cover member
having a stored position and an open position;
8 moving the first cover member from the stored position to the open
position in response to user operation of the activation button;
10 releasing a second cover member attached to the housing second end in
response to user operation of the activation button, the second cover member
12 having a stored position and an open position; and
moving the second cover member from the stored position to the open
14 position in response to user operation of the activation button.

25. The method of claim 24 wherein the act of moving the first and
2 second cover members from the stored position to the open position is
automatically performed in response to user operation of the activation button.

26. The method of claim 25, further comprising restricting a speed of
2 automatic movement of the first and second cover members from the first
position to the second position.

27. The method of claim 24 wherein the first cover member is
2 rotatably attached to the housing first end and the act of moving the first cover
member from the stored position to the open position comprises rotating the
4 first cover member from the stored position to the open position.

28. The method of claim 24 wherein the second cover member is
2 slideably attached to the housing second end and the act of moving the second
cover member from the stored position to the open position comprises sliding
4 the second cover member from the stored position to the open position.

29. The method of claim 24 for operation with a wireless
2 communication device having an output transducer mounted in second cover
member and operable to produce audio output signals wherein the act of
4 moving the first and second cover members to the open position places the
output transducer and the first cover member at a predetermined spaced apart
6 distance from each other.

30. The method of claim 24 for use with a wireless communication
2 device having a display, the method further comprising displaying a number
associated with an incoming call on a portion of the display.

31. The method of claim 30 wherein the display portion is covered by
2 the second cover member when in the stored position, the method further
comprising positioning a transparent portion of the second cover member in
4 proximity with the display portion wherein the act of displaying the number
comprises displaying the number through the transparent portion of the second
6 cover member.

32. The method of claim 31, further comprising generating a clock
2 signal and displaying the clock signal through the transparent portion of the
second cover member when the second cover member is in the stored position
4 and the wireless communication device is not receiving the incoming call.

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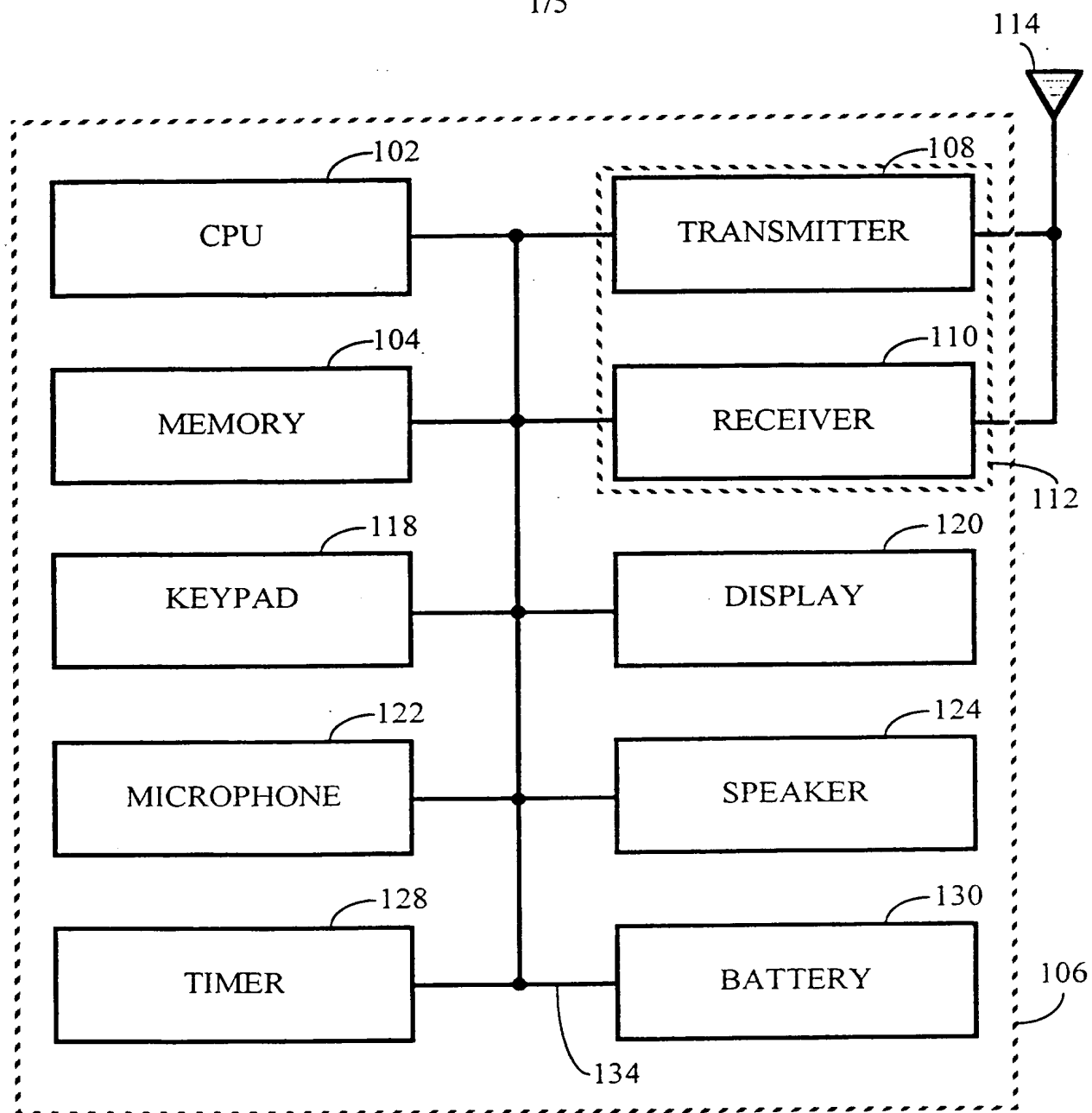


FIG. 1

100

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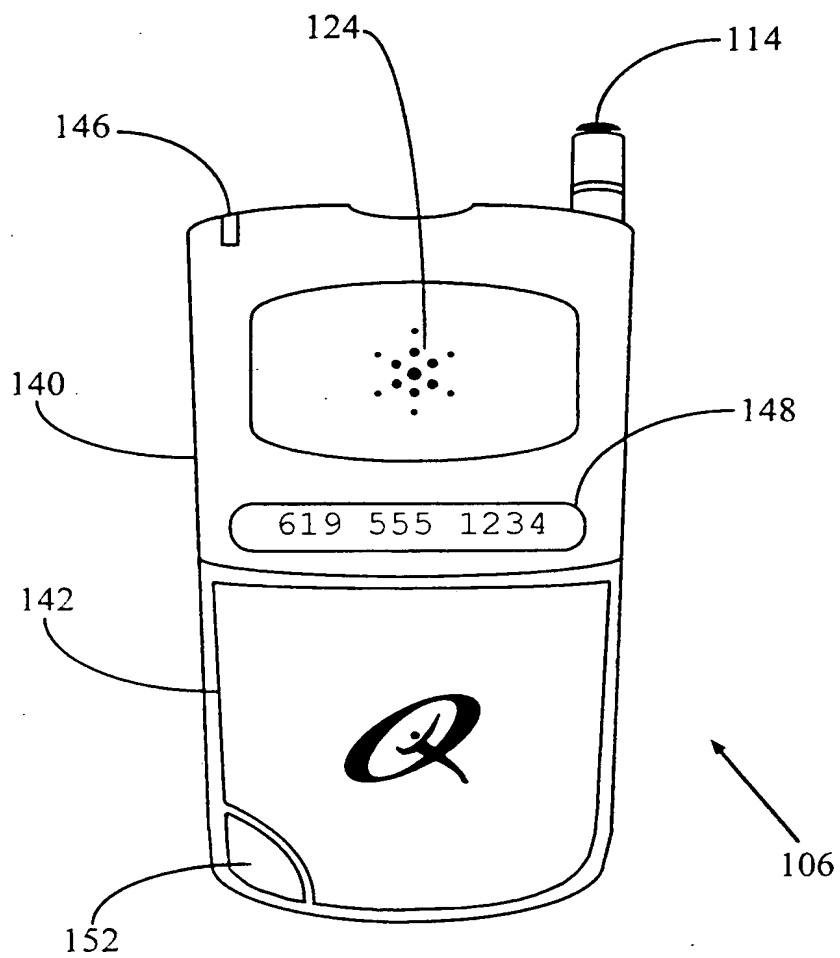


FIG. 2A

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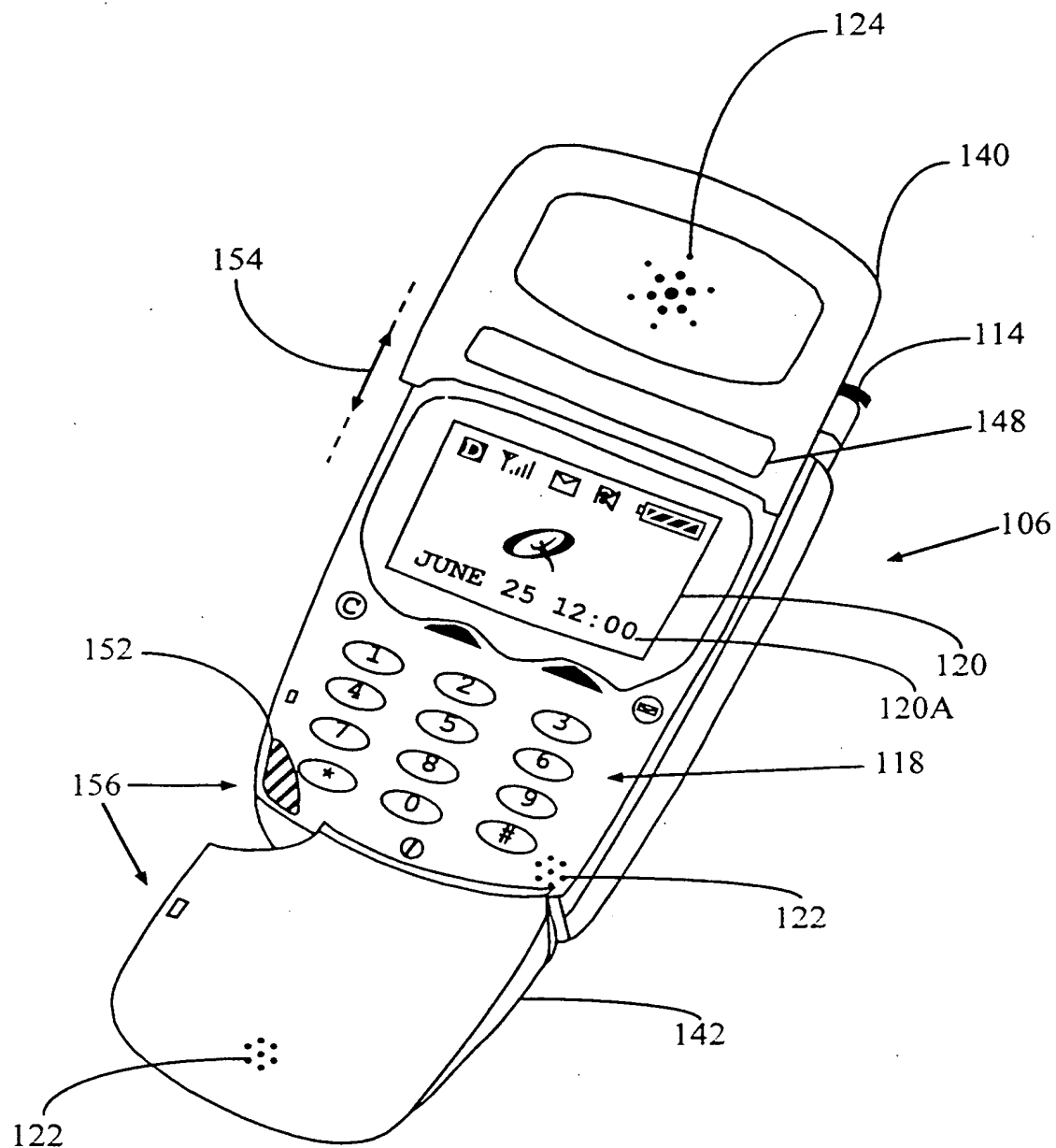


FIG. 2B

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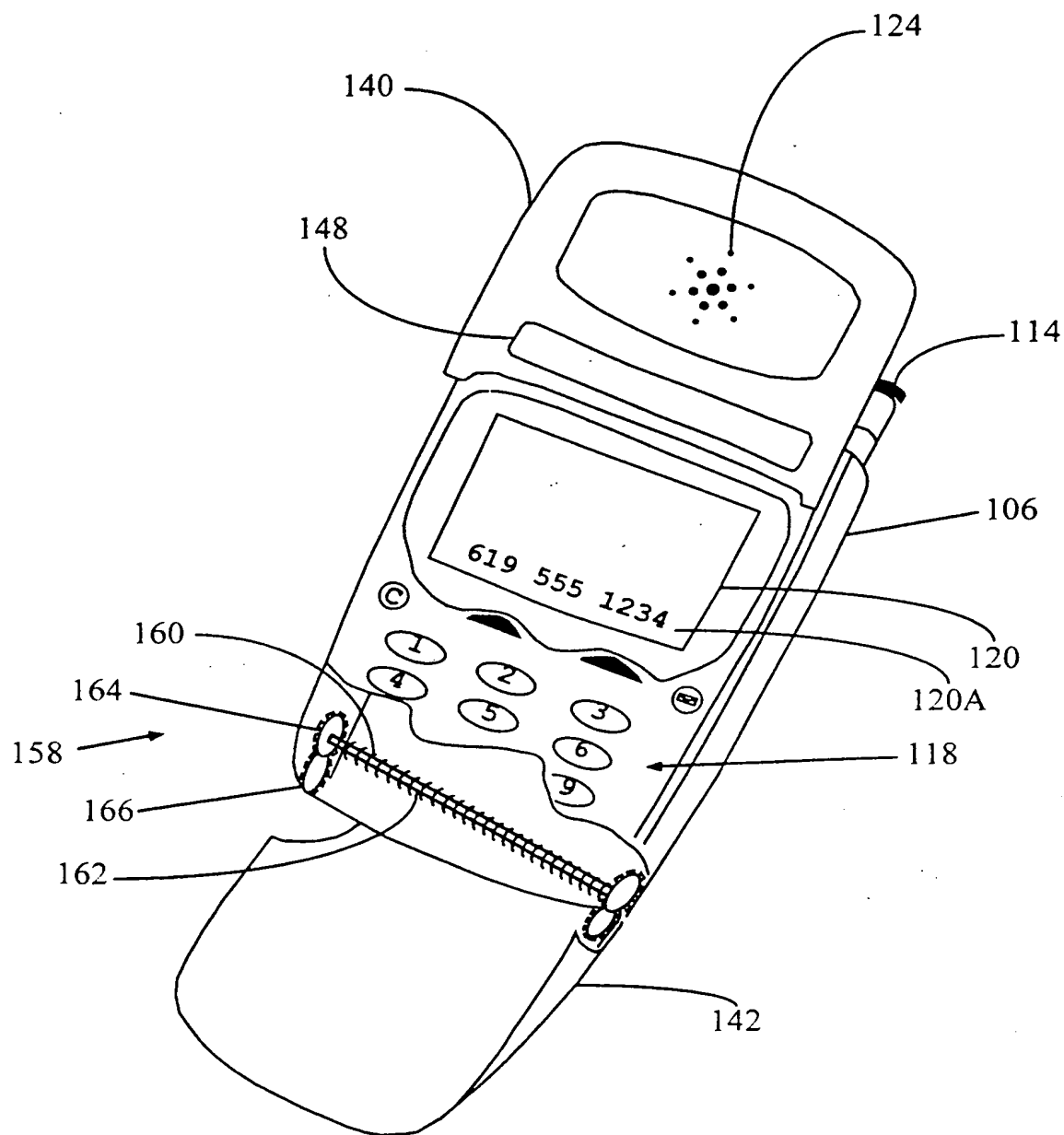
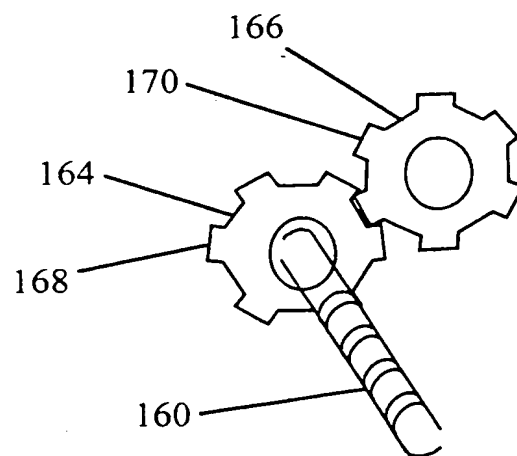
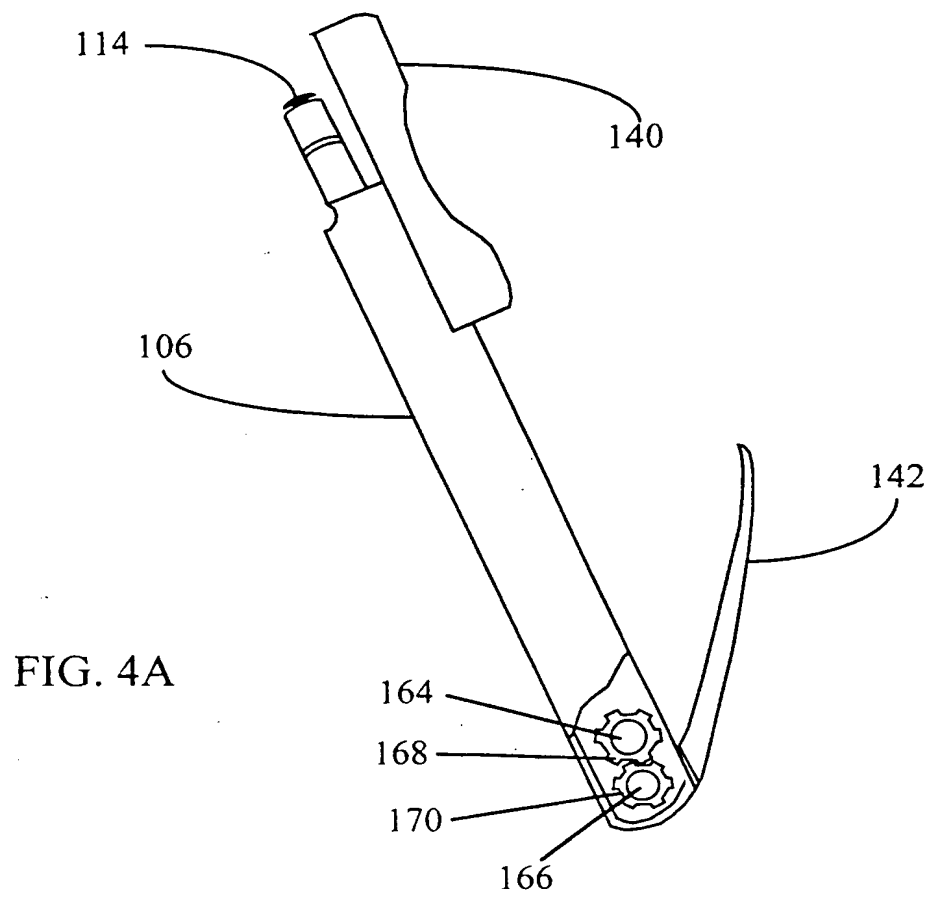


FIG. 3

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INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 99/18858

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04M1/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>WO 94 13088 A (MOTOROLA INC) 9 June 1994 (1994-06-09)</p> <p>page 19, line 23 -page 20, line 15; figures 5,6 page 21, line 1-10 page 21, line 25 -page 22, line 5 page 22, line 23-33 page 23, line 7-16 page 25, line 4-20</p> <p style="text-align: center;">--- -/--</p>	<p>1-3,6-9, 12-14, 17, 19-21, 23-25, 27-29</p>

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

18 November 1999

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/18858

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	EP 0 580 334 A (SONY CORP) 26 January 1994 (1994-01-26) column 3, line 9-23; figure 2 column 1, line 31-35 column 3, line 56 -column 4, line 3 column 9, line 5-27 ----	1,2, 13-15, 21,28,29
A	US 5 636 275 A (TAKAHASHI SHIGERU ET AL) 3 June 1997 (1997-06-03) claims 1,2; figure 9 ----	2-4, 8-10,26
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Information on patent family members

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PC1/US 99/18858

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